Remarks

Claims 1 through 17 remain pending in the application.

Generally, with respect to all of the claims, the Office Action misapprehends both the claims and the cited references. That KOH, NaOH and certain other bases can damage or even completely wear away silicon is known. The claims are directed to *when* a base, such as KOH, is used as an etchant during the chip manufacturing process and not simply to the use of a base as an etchant.

Applicant claims methods of etching wafers with a base during a specific point in the chip manufacturing process; specifically, after removing a portion of the backside layer of silicon from a wafer or after backgrinding a wafer. (The purpose of etching is to relieve stress in the device wafer.) Even though KOH and NaOH have been known as etchants for years, these chemicals were not used immediately after backgrinding to perform stress relief until Applicant's invention. Instead, environmentally dangerous acids have been used to perform etching after backgrinding and then bases used to neutralize the acids. The references cited by the Office Action either directly support this proposition or are silent on the issue. If using bases during this step of chip manufacturing had been obvious, then those skilled in the art would have just used a base to etch the wafer and not bothered with acids that are dangerous, expensive and onerous to use. Thus, if the claimed methods had been obvious, they already would have been known and used. Accordingly, the claims are non-obvious.

Now addressing the specific rejections, the Office Action rejects claims 1 through 4 and 13 through 15 as obvious over Humphrey, Microelectromechanical Device Manufacturing Process,

U.S. Patent 6,337,027 (Jan. 8, 2002) in view of Grupen-Shemansky, Method for Thinning a Semiconductor Wafer, U.S. Patent 5,268,065 (Dec. 7, 1993) under the assertion that Humphrey discloses a method of making a microelectromechanical (MEMS) device that includes a combination of backside grinding and wet etching with KOH to thin a sacrificial substrate; that Grupen-Shemansky (Grupen) teaches etching the backside of a wafer using a spin etcher; and that it would have been obvious to modify Humphrey by using the Grupen spray etcher to provide for the removal of material from the backside of the wafer with reduced internal stress.

Grupen explicitly teaches away from the claimed methods. Grupen does show a method of thinning a wafer during the process of manufacturing semiconductor devices. (Etching is performed for the purpose of relieving stress.) However, in the section of text cited by the Examiner, Grupen explicitly teaches the use of an acid to etch the wafer after the backgrinding step. Column 5, lines 7 through 26. A base, ammonium hydroxide and water, is then used to neutralize the acid. Column 5, lines 26 through 30. Had applicant's claims been obvious, then Grupen would not have taken the extra effort of using a base to neutralize the acid when Grupen could have just etched the wafer using a base in the first place. Instead, Grupen uses the acid to perform the etch process after backgrinding because that is what the art teaches during integrated chip manufacturing. Applicant's claims are contrary to this teaching, Grupen teaches away from the claims and thus the claims are non-obvious.

Similarly, no one would be motivated to combine the references. One of ordinary skill would read Humphrey and see that the wet etch (which generally involves complete immersion of the wafer) was used in a completely different manufacturing process than chip manufacturing. One of ordinary skill would read Grupen and merely assume that Grupen had disclosed what is already

known, and the disclosure regarding spin-etch with acid would add nothing to Humphrey. Thus, no one would be motivated to combine the references and so the claims are non-obvious.

In addition, the Office Action has not provided a motivation to combine the references. The Office Action states that it would have been obvious to combine the references "to provide the removal of material from the backside of the semiconductor wafer with reduced internal stress." This an advantage of Applicant's process, but the statement provides no reason for *why* one would be specifically motivated to combine these two references. For example, according to the Examiner's statement, one would be equally motivated to continue using acid as taught by Grupen since Grupen also provides for the removal of material with reduced internal stress. The Office Action has provided no reason why one skilled in the art would be motivated to perform the claimed method of using a base versus the method of using an acid disclosed by Grupen. Since the Office Action has not provided a motivation to combine the references, Applicant respectfully requests that the rejection be withdrawn.

In addition, the proposed combination does not result in the claimed method. Claims 1 through 4 and 13 through 15 require that a silicon wafer be provided, that an integrated circuit be built up on the front side of the wafer, that some of the substrate be removed, the backside of the wafer be etched with a base and that the wafer be rinsed. The proposed combination does not show a method of etching a device wafer with a base during the backgrinding step (backside silicon removal step) in the chip manufacturing process, as claimed. Thus, the Office Action has failed to state a prima facie case of obviousness with respect to claims 1 through 4 and 13 through 15.

In addition, Humphrey shows a process of making a MEMS device comprising bonding a Pyrex® base layer to a sacrificial silicon layer. The silicon layer is a wafer having structural elements,

but no integrated circuits. The silicon wafer is bonded to the Pyrex® substrate and then most of the silicon wafer is sacrificed, leaving the structural silicon elements on the Pyrex® substrate. Before the silicon wafer is bonded to the Pyrex® substrate, the silicon wafer is thinned by grinding and etching. (KOH is used to remove large amounts of silicon, not for stress relief and not during the claimed step in integrated circuit chip manufacturing.) During this step there are no circuits on the wafer. Only structural elements are disposed on the wafer. Thus, if the spin etch method of Grupen were used with the Humphrey production method, the combination would not be a method of preparing an integrated circuit and would not meet the claimed limitations. Accordingly, the Examiner has not established a prima facie obviousness rejection.

The Office Action rejects claims 5 through 12 and 16 as obvious over Humphrey in view of Grupen and in view of Frazier, et al., Micromachined Electrical Field-Flow Fractionation System, U.S. Patent 6,136,171 (Oct. 24, 2000) under the assertion that Humphrey and Grupen teach a method of spin-etching a wafer with KOH; that Frazier teaches the use of a 20% solution of KOH for the bulk etching of a silicon wafer; and that it would have been obvious to use a 20% KOH etchant solution to provide a desirable etch rate while thinning the semiconductor wafer substrate.

Claims 5 through 12 and 16 are non-obvious for the reasons given above. In addition, Frazier shows a completely unrelated device and method for field-flow fractionation which adds nothing to the proposed combination. Frazier does show a method of making his device. During the production of his device he etches bulk silicon by dipping silicon in KOH for 24 hours. However, Frazier does not show a method of etching a wafer to relieve wafer stress after the backgrinding step of integrated circuit production. At best, with respect to the claimed methods, Frazier shows that KOH can dissolve silicon; however, this fact is disclosed in Humphrey

and elsewhere in the art. Thus, Frazier is cumulative to Humphrey and adds nothing to the proposed combination, regardless of the concentration of the KOH. Accordingly, the claims remain non-obvious.

In addition, the Office Action has not stated a motivation to combine the references. The Office Action has stated a possible advantage to the proposed combination, but has not stated why one of ordinary skill would be motivated to combine the references. The Office Action states that it would be obvious to use 20% KOH "to provide a desirable etch rate while thinning the semiconductor substrate." This statement is without foundation and cannot be a motivation to combine the references.

The Office Action rejects claim 17 as obvious over Humphrey in view of Tamatsuka, Method for Producing SOI Substrate and SOI Substrate, U.S. Patent 6,224,668 (May 1, 2001) under the assertion that Humphrey discloses a combination of backside grinding and wet etching in KOH, dividing the wafer into individual die, forming electrical connections and attachment of the die to a system level substrate, such as a circuit board, hybrid substrate or hermetic package; that Tamatsuka teaches the equivalence of etching a bonded silicon substrate using either KOH or NaOH; and that it would have been obvious to modify Humphrey by using NaOH as the wet etchant since Tamatsuka teaches the equivalence of NaOH to KOH as a silicon wet etchant.

As described above, Humphrey does not show the claimed method. Tamatsuka shows a method of producing a silicon on insulator substrate. At best, with respect to the claims, Tamatsuka shows that bases such as KOH and NaOH can etch silicon. This concept is cumulative to Humphrey and so Tamatsuka adds nothing to Humphrey vis-à-vis the claimed methods. Thus, the proposed combination does not result in the claimed method. Accordingly, the claimed method is non-obvious.

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Conclusion

This response has addressed all of the Examiner's grounds for rejection. The rejections based on prior art have been traversed. Reconsideration of the rejections and allowance of the claims is requested.

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